Social and Environmental Concerns of Flower Farms in Central Ethiopia

Biruk Gobena[1*], Abera Kinfu[2], Mohammed Berhanu[3]

Ethiopian Environment & Forest Research Institute, Environmental Pollution Management Research Directorate, Addis Ababa, Ethiopia
*Corresponding author

Abstract— *The extensive use of fertilizers and pesticides in the flower farming industries has been linked to negative environmental and social impacts. The cross-sectional study was conducted to assess social and environmental concerns of flower farms in Central Ethiopia using questionnaires, focus group discussion and field visits. This study revealed that 317 (52.75%) of respondents reported that flower farms have been disposing of their flower residue of in the open field. The findings of this study showed that 216(36%) of inhabitants buy or receive empty chemical bags and containers that had been disposed by the flower farms. Focus Group Discussion participants perceived the decrease in volume and quality of groundwater, a decrease in productivity, land degradation, and increased emerging diseases due to the existence of flower farms in the area.. In addition, they reported abuse of employee rights, displacement of farmers from fertile land, death of cattle and fish, loss of acceptance for their agricultural and fish products. In conclusion, this study revealed that there are a poor waste management and unsustainable activities by the flower farms. The government should closely monitor these farms and undergo a holistic study to quantify environmental and local inhabitant's opportunity costs of flower farming activity.*

Keywords— Flower farm, Waste management, Environmental pollution, Pesticides, Fertilizer, Human health.

I. INTRODUCTION

Ethiopia started to enter the flower export market in the mid- 1990s at the time when the European Union (EU) market was much more demand-driven, and as a result, increasingly stringent standards and regulations had been instituted. In less than a decade, the country became the fifth largest non-EU flower exporter to the EU market and the second-largest exporter from Africa, surpassing all early exporter countries except Kenya (Gebreeyesus & Sonobe, 2012; Gezmu, 2013). Ethiopia generated over 178 million USD from flower exports. Although the contribution of the sector to GDP growth is undeniable, many scholars are doubtful about the long-term impacts of this sector on the environment and welfare of the rural families, in areas where flower farms are developed (Gezmu, 2013).

Due to the rapid growth of the floriculture industry, flower farms in Ethiopia have imported 96 types of insecticides and nematicides, and 105 types of fungicides from 2007 to 2014 (Tilahun 2013; MoA, 2014). Most growers rank pesticides second on their list of expenditures, next to international (air) transport costs (Mengistie *et al*., 2017). As a result, many have become concerned about the potential adverse environmental impacts of flower farms. Fertilizers and pesticides used extensively in the industry have been linked to negative environmental and health impacts (Getu, 2009; Gadaa, 2010; Hatch & Wells, 2012).Pesticides (including herbicides, insecticides, fungicides, etc.) can contaminate organisms, soil, water, turf, and other vegetation (Hatch & Wells, 2012). The adverse effect of pesticide use includes degrading water and soil quality, the effect on non-targeted lives like soil organisms, aquatic life, human beings, insects, cattle, etc, air pollution, and increase of pesticide resistance by targeted pests (Getu, 2009; Tilahun, 2013).

On other hand, the fact that they are often harmful to the environment, fertilizers are used in many different forms of agriculture to increase the level of crop production by adding nutrients to the soil that benefit the growth of plants (Getu, 2009). The residue of these fertilizers can cause water pollution, eutrophication of freshwaters, and increased nitrate concentrations in ground and surface waters (Hatch & Wells, 2012). The long-term use of inorganic fertilizers can also be detrimental to the soil because it can kill nitrogen-fixing bacteria and other beneficial organisms (Pimentel *et al*., 1995). As a result, more fertilizers are applied each year to make up for the loss of natural microorganisms and micro-nutrients (Getu, 2009; Hatch & Wells, 2012).

Many studies were performed focusing on occupational health, employee's rights, water pollution, soil pollution, waste management, and so on. However, there are none or a few who collected data from the surrounding residents who can give better testimony regarding the health impacts, the local inhabitants' benefit, the solid waste management practice, and social

complaints of flower farming industries. It is important to collect data from a different source to generate reliable information. The local inhabitants are the mosaic of the industry employee, the farmers, and other residents; they can be taken as watchdog that is following what is happening inside the compound as well as the surrounding environment. Therefore, in this study, the social and environmental concerns witnessed by nearby inhabitants of flower farms were tried to be assessed.

II. MATERIAL AND METHODS

2.1 Study Areas

This study assessed the environmental and social consequences inhabitants living around five flower farms (Farm 1, Farm 2, Farm 3, Farm 4, and Farm 5) in Central Ethiopia. The flower farms' location was depicted in Figure 1. Farm 1 and Farm 2 are found in the Southwest Shewa zone (Woliso Woreda and Bacho Woreda, respectively). Farm 3 and Farm 4 are found in the West Shewa zone (Walmera Woreda). And, Farm 5 is located in the East Shewa zone, Adami Tulu Jido Kombolcha Woreda. These flower farms were purposely selected for this study based on the intensity of the social complain as per the local Environment, Forest, and climate change authority recommendation.

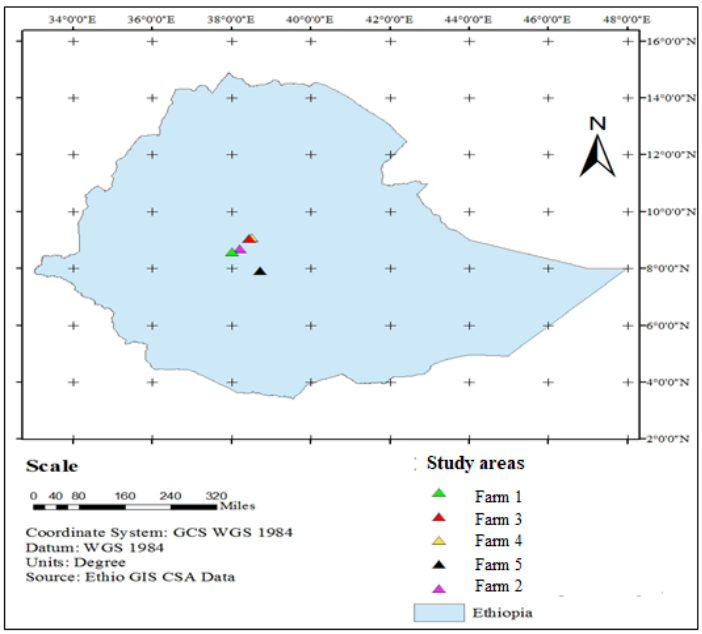

FIGURE 1: Study areas

2.2 Study Design and Period

The cross-sectional study was conducted to assess social and environmental consequences observed by nearby inhabitants living within a 2 km radius of flower farms in 2019 using questionnaires, focus group discussion (FGD), and field visit.

2.3 Sample Size Determination

The sample size was determined using a Cochrans formula (G*len, 2020)* at a 95% confidence interval and 4 margin of error. Systematic random sampling techniques were employed to determine the number of samples per study site. A total of 601 sample size was determined which is allocated to the flower farms based on the land surface area the flower farms have occupied.

2.4 Sampling Technique

It is not appropriate to use the whole residents of a kebele to determine study subjects for this specific study. Therefore, we have set a benchmark indicating a 2 km distance from the flower farm in four directions using GPS and collected data from those living in the specified distance. The sample size per flower farm was determined based on the assumption of "The land area the flower farms are using is proportional to the number of residents affecting." Accordingly, the data were collected from 53, 53, 53, 53, and 389 inhabitants in a 2km radius of Farm 1, Farm 2, Farm 3, Farm 4, and Farm 5, respectively.

2.5 Data Collection Process

Data was collected by urban health extension professionals and experts from concerned woreda Environment, Forest, and climate change Authority who has taken detail orientation on data collection tool. Data was gathered from randomly selected individuals of inhabitants around flower farms by questionnaire and four Focus group discussion (FGD) discussion having 15 members in which farmers, residents, and concerned experts have participated. In addition, field observations were also held using checklist and camera.

III. RESULTS AND DISCUSSION

3.1 Socio-demographic characteristics of the respondents

A total of 601 households (HHs) were included in this study. Among households' study participants, 317(52.75%) were male and 284 (47.25%) were females. The majority of the study participants were found in the age range of 20-45 (77.7%). Regarding the occupational and educational status of respondents, 14(2.33%), 125(20.80%), 224(37.27%), 97(16.14%), of the respondents were government workers, private business, farmer, and unemployed, respectively. Among study participants, 147(24.46%), 217(36.11%), 136(22.63%), 52(8.65%) of them reported as they had grade 9-12, grade 1-8, illiterate, can read and write, respectively. Four hundred ninety-eight (82.86%) respondents were lived in the area for more than 11 years. The results are presented in Table 1.

TABLE 1
SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

Characteristics		IA Farm 1		IA Farm 2		IA Farm 3		IA Farm 4		IA Farm 5		Total	
		Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Gender	Male	40	75.47	33	62.26	31	58.49	32	60.38	181	46.53	317	52.75
	Female	13	24.53	20	37.74	22	41.51	21	39.62	208	53.47	284	47.25
	Total	53	100	53	100	53	100	53	100	389	100	601	100
Age	20-35	9	16.98	21	39.62	15	28.30	20	37.74	189	48.59	254	42.26
	36-45	19	35.85	18	33.96	17	32.08	19	35.85	140	35.99	213	35.44
	>45	25	47.17	14	26.42	21	39.62	14	26.42	60	15.42	134	22.30
	Total	53	100	53	100	53	100	53	100	389	100	601	100
Educational status	First Degree	0	0.00	2	3.77	0	0.00	0	0.00	8	2.06	10	1.66
	10 + 3	0	0.00	0	0.00	0	0.00	0	0.00	40	10.28	40	6.66
	Grade 9 to 12	17	32.08	11	20.75	14	26.42	9	16.98	96	24.68	147	24.46
	Grade 1 to 8	18	33.96	11	20.75	20	37.74	15	28.30	153	39.33	217	36.11
	Illiterate	2	3.77	25	47.17	10	18.87	25	47.17	74	19.02	136	22.63
	Read and write	16	30.19	4	7.55	9	16.98	4	7.55	19	4.88	52	8.65
	Total	53	100	53	100	53	100	53	100	389	100	601	100
Type of job	Government	0	0.00	0	0.00	1	1.89	0	0.00	13	3.34	14	2.33
	Private business	2	3.77	7	13.21	0	0.00	3	5.66	113	29.05	125	20.80
	Farmer	46	86.79	43	81.13	31	58.49	28	52.83	76	19.54	224	37.27
	Unemployed	0	0.00	1	1.89	0	0.00	20	37.74	76	19.54	97	16.14
	Other	5	9.43	2	3.77	21	39.62	2	3.77	111	28.53	141	23.46
	Total	53	100	53	100	53	100	53	100	389	100	601	100
Residence duration in years	<5	0	0.00	0	0.00	0	0.00	3	5.66	8	2.06	11	1.83
	5 to 10	0	0.00	2	3.77	0	0.00	13	24.53	77	19.79	92	15.31
	11 to 20	7	13.21	10	18.87	2	3.77	7	13.21	104	26.74	130	21.63
	>20	46	86.79	41	77.36	51	96.23	30	56.60	200	51.41	368	61.23
	Total	53	100	53	100	53	100	53	100	389	100	601	100

3.2 Waste management gap of flower farms

Waste can be produced during each process of flower farming. It is estimated that up to 500 tons of residues per hectare per year are generated from flower farms (Tilahun, 2013). The Anano village residents, one of Adami Tullu Jido Kombolcha district villages, use flower farm residue to feed their cattle as an alternative feedstuff especially during the scarcity of fodder (Figures 2a and 2b). It is becoming common to see when cattle are eating flower residue from the flower farms in the village. During field observation, the residents reported that they had encountered scarcity of fodder to feed their cattle especially in dry seasons; when most fields are bared for grazing. Consequently, the inhabitants are forced to use cut flower residue that they get it by purchase. Even this harmful flower waste is not affordable for most farmers to buy. The residents added that the flower farm they are buying smells like a dead body. This could be an indication of chemically contaminated wastes. The residents of the village were asked if the flower residue feedstuff has solved their problem. Accordingly, they have replied that the feedstuff has helped them to sustain the life of their cattle. On another way, the users of the cut flower residue reported that they haven't enough awareness if their practice can harm cattle and human health in the long term. However, plants grown in farms where pesticides are applied may thus become contaminated and consequently, pesticide residues are transferred to milk when these plants are fed to cows (Ismail, 2009). Several studies in tropical areas showed positive milk samples (Asselt *et al*., 2016).

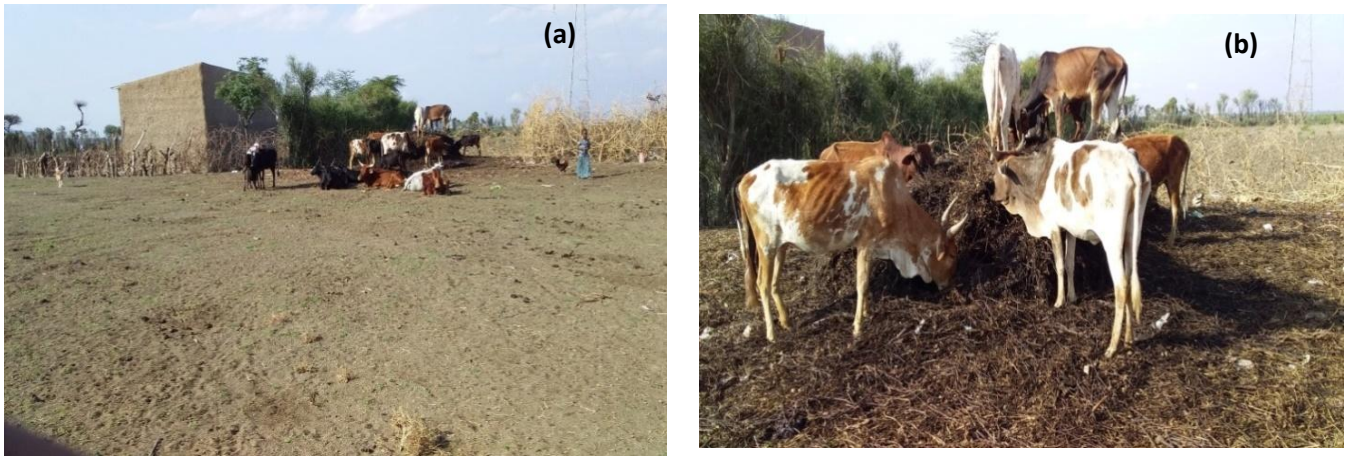

FIGURE 2: Pictures showing cattle feeding on flower residue

In addition, we observed wastewater is discharged from the compound of some flower farms. As it was tried to illustrate in Figures 3a and 3b, this discharged wastewater is added to the nearby water body, drink up by cattle, or fetched by residents for uses.

FIGURE 3: Pictures showing the waste management gap of flower farms

3.3 Respondents flower farm empty chemical container use status

Another environmental concern in the flower farming is the unsafe management of pesticide containers (Tilahun, 2013; Mengistie *et al*., 2017). To assess whether they receive/buy chemical bag/containers from flower farms, residents living

around flower farms were asked. The result showed that 216 (35.94%) of inhabitants receive/buy the chemical bags/containers, respectively. Residents reported that they get the materials from guards and employees of the flower farms (Figure 4).

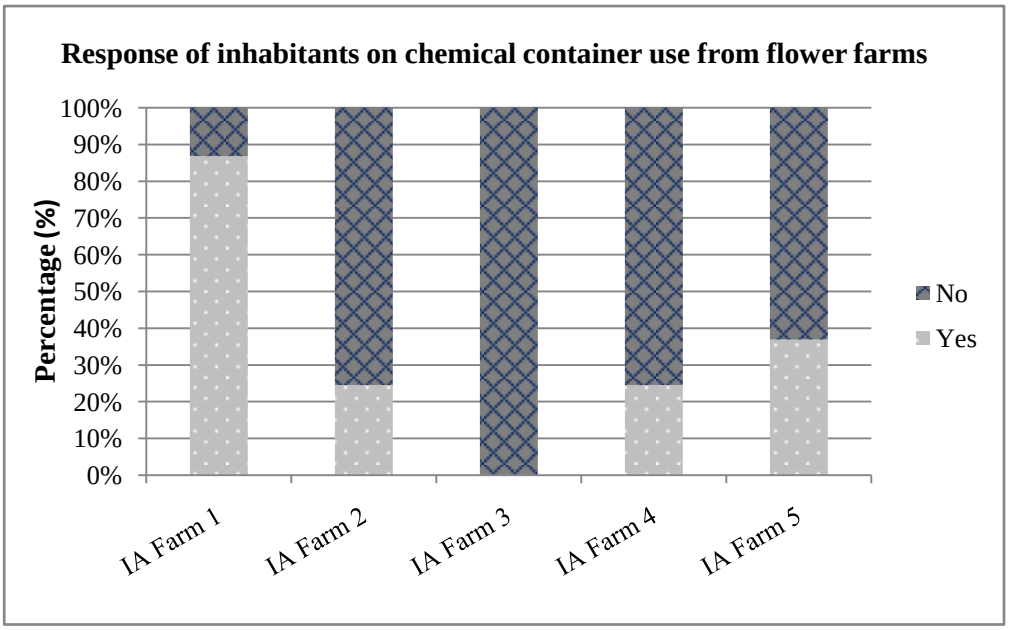

FIGURE 4: Response of inhabitants on chemical container use discharged from flower farms.

The local inhabitants were also asked for what purpose they use the chemical container they received/bought. Accordingly, 28(60.87%), 11(23.91%), and 7(15.22%) of respondents around Farm 1 use it to fetch and store water, to make and store Tella and Areki (Cultural Alcoholic drink in Ethiopia), and for sale, respectively. Whereas all inhabitants around Farm 2, reported they use it to fetch and store water, only. Regarding inhabitants around Farm 4, 8(61.54%) and 5(38.46%) use it to fetch and store water, and to make and store Tella and Areki, respectively. While, 102(70.83%), 17(11.81%), and 15(10.42%) of inhabitants around Farm 5 use it to fetch and store water, for house shade, and to make and store Tella and Areki, respectively (Figure 5).

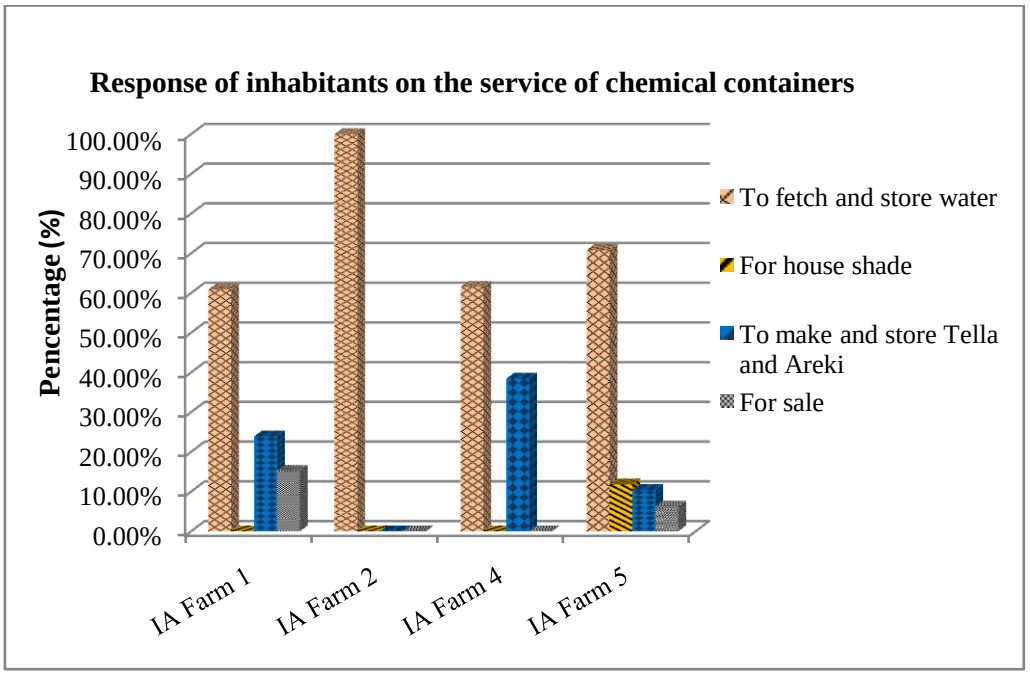

FIGURE 5: Response of inhabitants on the service of chemical containers

The researchers have tried to make field visits in the vicinity around flower farms to check if empty chemical containers are haphazardly disposed of in the immediate environment. As depicted in Figure 6(a) empty chemical bags were disposed of

haphazardly which further enter into the water body or eaten by cattle's grazing around the compound. Among empty chemical containers, we had a chance to take pictures of residents fetching water with Jerry Cans from which chemical was emptied (Figure 6b).

FIGURE 6: (a) Picture showing an empty chemical bag is haphazardly disposed of in the immediate environment. (b) Picture showing a person fetching water with Jerry cans from which chemical was emptied

3.4 Social complaint on the flower farms

In this survey, we have tried to identify how many of the inhabitants around the flower farms raised complain regarding the flower farm problems in their vicinity. Accordingly, 463 (77.04%) of inhabitants have reported they had raised a complaint. Whereas, 57(9.48%) of inhabitants have reported they have no complaint. The results are shown in Figure 7.

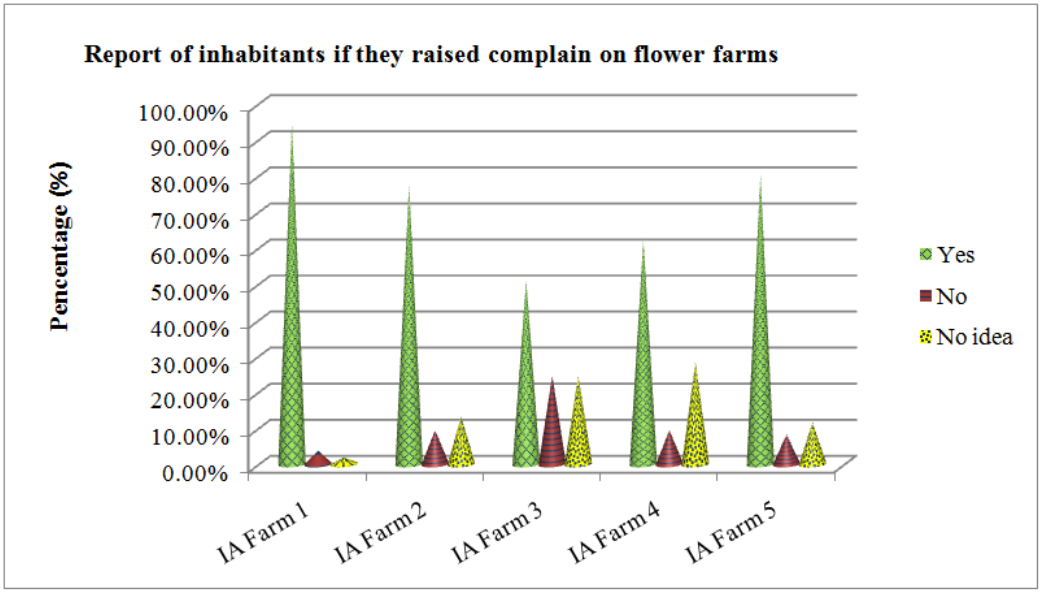

FIGURE 7: Report of inhabitants if they had risen to complain about flower farms

The respondents were asked for the cause of complaint in their vicinity. Accordingly inhabitants around flower farms reported high flood from the greenhouse (Farm 1; Farm 2), high water abstraction (Farm 1; Farm 3), chemical contamination of nearby lands (Farm 1; Farm 2; Farm 4; Farm 5), loss of local vegetables and fish acceptability on the market (Farm 1; Farm 2), decrease of crop yield (Farm 3; Farm 4). Also, unfair compensation (Farm 1; Farm 2), unwillingness to implement its promises (Farm 1; Farm 2), unfair wage (Farm 1), loss farmland (Farm 4) were raised as a complain. Furthermore, occupational injury, abuse of employee rights, health problems, death of cattle and fish, funeral area demolishment, chemical odor problem, reduced drinking water resource due to contamination were listed by inhabitants around Farm 5. This result is in agreement with the findings of Gezmu (2013); Hatch & Wells (2012), Mengistie *et al*. (2017), Gudeta (2012), and NAPE (2012).

3.5 Inhabitants flower farms benefits perception

It is undeniable that cut flower production is now a major part of the Ethiopian economy and has shown considerable potential for Ethiopia in terms of creating employment opportunities and foreign exchange earnings (Zegeye 2013).This study revealed that 27(50.94%), 10(18.87%), and 10(18.87%) inhabitants around Farm 1 have confirmed that they get a job opportunity, drinking water, and school, respectively. Among inhabitants around Farm 2, 23(43.40%) and 25(47.17%) has confirmed that they got job opportunity and water supply, respectively. Similarly, 23(43.40%) of inhabitants around Farm 4 have confirmed that they get the job opportunity. While, 30(56.60%) responded that they get nothing from the flower farm, respectively. On another hand, 209(53.73%) and 117(30.08%) inhabitants around Farm 5 have reported that they have got job opportunities, and school, respectively. Also, inhabitants around Farm 3 were asked to list the benefit they get as a resident of the vicinity. Accordingly, 19(35.85%) have confirmed that they got job opportunities. The result is presented in Figure 8.

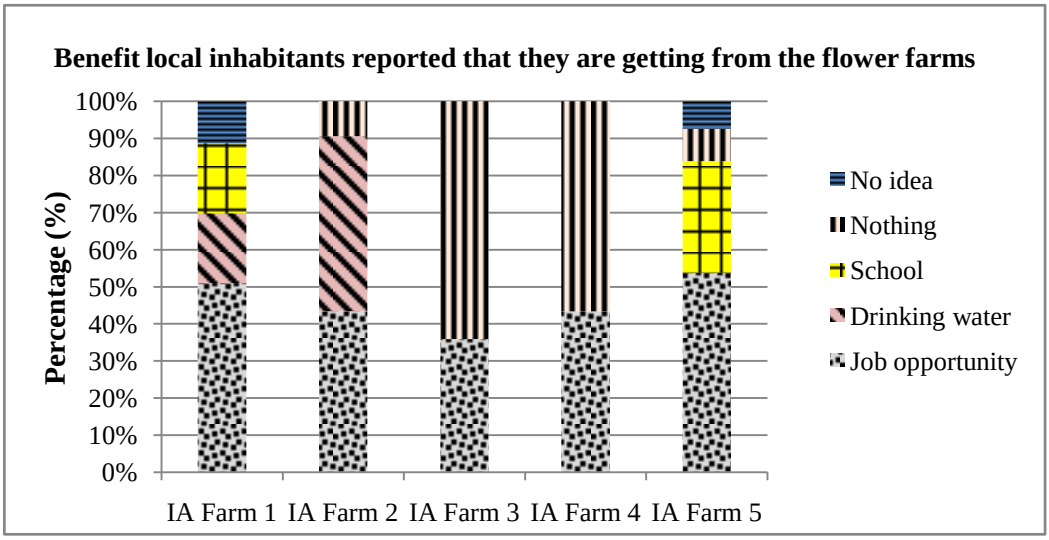

FIGURE 8: Benefit local inhabitants reported that they are getting from the flower farms

3.6 Local Inhabitant's degree of satisfaction about the flower farm activity

A developmental project should ensure the benefit of the local community besides its national role. Accordingly, residents around flower farms were asked about their satisfaction level 213 (35.44%), and 342(56.91%) of HHs were responded that they were "Slightly satisfied" and "Not at all satisfied", respectively. The results are presented in Figure 9.

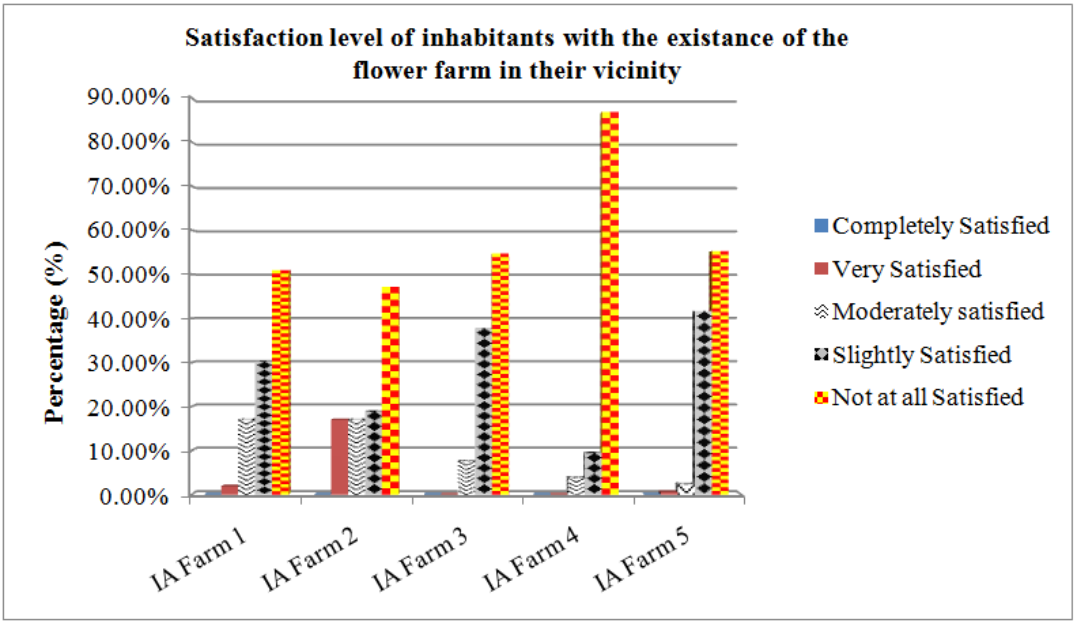

FIGURE 9: Satisfaction level of inhabitants with the existence of the flower farm in their vicinity

The respondents were asked to report diseases and injuries they have perceived it was occurring newly or increasing due to flower farms in their vicinity. Consequently, the inhabitants residing around the flower farms reported Eye irritation (Farm 1; Farm 5), Asthma (Farm 1; Farm 2; Farm 5), Bad smell (Farm 1; Farm 4), cough (Farm 1; Farm 2; Farm 5), skin lesion (Farm 1; Farm 5), lung disease (Farm 2), and Malaria (Farm 1; Farm 2). Exclusively, inhabitants living around Farm 5 flower farms reported weight loss, headache, miscarriage, disability and death, shortness of breath, diarrhea, convulsion, and wounding of hands and other body. Studies also indicate that the neighboring communities complain of a smell from pesticides spray in the greenhouses (Tilahun, 2013; Tizazu & Workie, 2018). Literatures do support the findings of this study regarding the possible health impacts of pesticide. Pesticide can cause acute effects such as nerve, skin, and eye irritation and damage, headaches, dizziness, nausea, fatigue, vomiting, abdominal pain, and systemic poisoning. Major acute effects can cause respiratory problems, nervous system disorders, and aggravation of pre-existing conditions such as asthma (Singh *et al*., 2017).

A focus group discussions held on April 2019 revealed the existence of significant complaints in the community regarding the flower farm industry. These complaints traverse a wide range of issues and aspects related to the flower farms. Participants in the focus group discussions referred to environmental, wellbeing, financial, and personal issues.

A common dominator of the views expressed by all focus group participants regarding perceived flower farms negative impact is the decreased volume and quality of groundwater, a decrease of productivity, land degradation, increased emerging diseases, abuse of employee right, displacement of farmers from fertile land, death of cattle and fish, loss of acceptance for their agricultural and fish product. Participants reported perceived changes in their environment attributed to flower farms such as a change in color and odor of water body, spring has terminated, decreased water table, bad smell, decreased groundwater yield, and decrease in fish production. The key words most commonly brought up across all four focus groups included water, health problems, occupational injury, abuse of employee rights, farmland, cattle death, productivity, and fertility.

IV. CONCLUSION AND RECOMMENDATIONS

In this study it was tried to show the social and environmental issues such as waste management, empty chemical bag/container misuse, social grievance of the farm, residents benefit from the farm, and inhabitant's degree of satisfaction around flower farms. Accordingly, the main issues reported were high flood from the greenhouse, unfair compensation, uncontrolled water abstraction, unfair wage for the employee, chemical contamination of nearby land and water, loss of local vegetables and fish acceptability on the market, loss farmland, decrease of crop yield, occupational injury, abuse of employee rights, health problems, death of cattle and fish, and chemical odor problem.

In general, it was reported that there is a poor waste management and unacceptable activities by the flower farms. As a result, inhabitants around flower farms broadly manifest high social grievance and dissatisfaction. Every developmental activity has its own negative impact, which ranges from low to high, reversible to irreversible and short-term to long-term. The cost-benefit analysis of such a sector should be well examined and recognized. The fact that this study has tried to hear from the community, the government should strongly and closely monitor these farms if the firms are acting according to their environmental management plan. Also, detail and holistic study is still highly required to quantify environmental and social opportunity costs of flower farming activity.

ACKNOWLEDGMENTS

First, we would like to acknowledge the Woredas' Environment, Forest, and Climate Change Authority and Health office for assigning experts for data collection during the survey. Then, we would like to thank data collectors, the inhabitants around flower farms, and FGD participants of the study. In addition, we are glad to acknowledge the Ethiopian Environment and Forest Research Institute for financial support.

REFERENCES

[1] Gadaa, A. 2010. The Impact of Flower Industry in Oromia, Ethiopia. Retrieved September 23, 2012, from http://flowerindustry.afrogadaa.org/#home.

[2] Gebreeyesus, M., & Sonobe, T. 2012. Global Value Chains and Market Formation Process in Emerging Export Activity: Evidence from Ethiopian Flower Industry. In Journal of Development Studies (Vol. 48, Issue 3). https://doi.org/10.1080/00220388.2011.635199

[3] Getu, M. 2009. Ethiopian Floriculture and its Imapct on the Environment : Regulation, Supervision and Compliance. Mizan Law Review, 3(2), 240–270.

[4] Gezmu, A. B. 2013. The Human Impacts of Flower Farm Development in the Ethiopian Rift Valley Region. University College Cork.

[5] Glen S. 2020. "Sample Size in Statistics (How to Find it): Excel, Cochran's Formula General Tips" From SatisticsHowTo.com: Elementary Statistics for the rest of us. Retrieved on August 8, 2020 from https://www.statisticshowto.com/probability-and-statistic/find-sample-size/

[6] Gudeta, D. 2012. Socio-economic and Environmental Impact of Floriculture Industry in Ethiopia [Humboldt University of Berlin (Germany)]. http://lib.ugent.be/fulltxt/RUG01/001/894/550/RUG01-001894550_2012_0001_AC.pdf

[7] Hatch N. & Wells L. 2012. Environmental Policy Update 2012 : Development Strategies and Environmental Policy in East Africa Chapter 4 . A Delicate Balance : Land Use Planning in the Gambella Region of Ethiopia Environmental Policy Update 2012 : A Delicate Balance : Land Use Planni.

[8] Ismail, M. 2009. Corporate Social Responsibility and its Role in Community Development: An International Perspective. The Journal of International Social Research, 2(9), 200–209.

[9] Mengistie, B. T., Mol, A. P. J., & Oosterveer, P. 2017. Governance of agro-pesticide through private environmental and social standards in the global cut flower chain from Ethiopia. Ambio, 46(7), 797–811. https://doi.org/10.1007/s13280-017-0914-x

[10] Ministry of Agriculture (MoA)-Ethiopia. 2014. Pesticide imported for flower production. PHRD of MoA. Unpublished official reports.

[11] National Association of Professional Environmentalists (NAPE). 2012. the Impacts of the Flower Industry on Environment and Peoples Livelihoods in Uganda (Issue June).

[12] Pimentel, D. 1995. Amounts of Pesticides Reaching Target Pests: Environmental Impacts and Ethics. Journal of Agricultural and Environmental Ethics, 8(1).

[13] Singh N.S., Sharma R., Parween T., & Patanjali P.K..2017. Pesticide Contamination and Human Health Risk Factor. In M. Oves et al (Ed.), Modern age environmental problems and their remediation (Issue January, pp. 49–68). Springer International Publishing AG 2018. https://doi.org/10.1007/978-3-319-64501-8

[14] Tilahun, A. 2013. Environmental Impacts of Floriculture Industry in Debrezeit Town : a Need for Strategic Environmental Assessment Environmental Impacts of Floriculture Industry in Debrezeit Town : a Need for Strategic Environmental Assessment (Issue July). Addis Ababa University.

[15] Tizazu, T. Y., &Workie, M. A. 2018. Social, Economical and Environmental Issues of Floriculture Sector Development in Ethiopia. Review of Plant Studies, 5(1), 1–10. https://doi.org/10.18488/journal.69.2018.51.1.10

[16] Van Asselt, E.D., Marvin, H.J.P., Boon, P.E., Swanenburg, M., Zeilmaker, M., Mengelers, M.J.B. and van der Fels-Klerx, H.J., 2016. Chemical and physical hazards in the dairy chain (No. 2016.003). RIKILT Wageningen UR.

[17] Zegeye, T. 2013. Corporate Social Responsibility Programmes in Ethiopian Floriculture Industry. St.Mary's University College.